

The flattening of the yield curve : causes and economic policy implications

M. Collin⁽¹⁾

Introduction

The risk-free yield curve, namely the graph representing the link between the interest rate and the time to maturity of government bonds, is an important information source for central banks. For example, the slope of the yield curve – measured as the difference between long-term and short-term interest rates – is traditionally regarded as a relatively reliable leading indicator of economic activity. Thus, a narrowing of the rate differential is usually followed a few quarters later by a marked slowdown of the economy, while a widening is generally accompanied by an acceleration of economic growth. Long-term yields also provide an indication of long-term inflation expectations, and hence of the credibility of monetary policy.

Since mid 2004 there has been a marked flattening of the risk-free yield curve in the euro area and in other industrialised countries, raising numerous questions about the future economic trend and, to a lesser extent, about inflation expectations. This article examines the reasons for that flattening in the euro area and its economic policy implications. In view of the size of the American financial markets and the growing financial integration, the article also takes a look at the situation in the United States.

The article is arranged as follows. In the first section, the current situation is viewed in a historical perspective. This section also examines the extent to which recent developments may have affected the quality of the yield curve as an indicator of future economic fluctuations and inflation expectations. The second section analyses the various factors which may have caused the flattening of the yield curve. The final section presents the conclusions.

1. Flattening of the yield curve

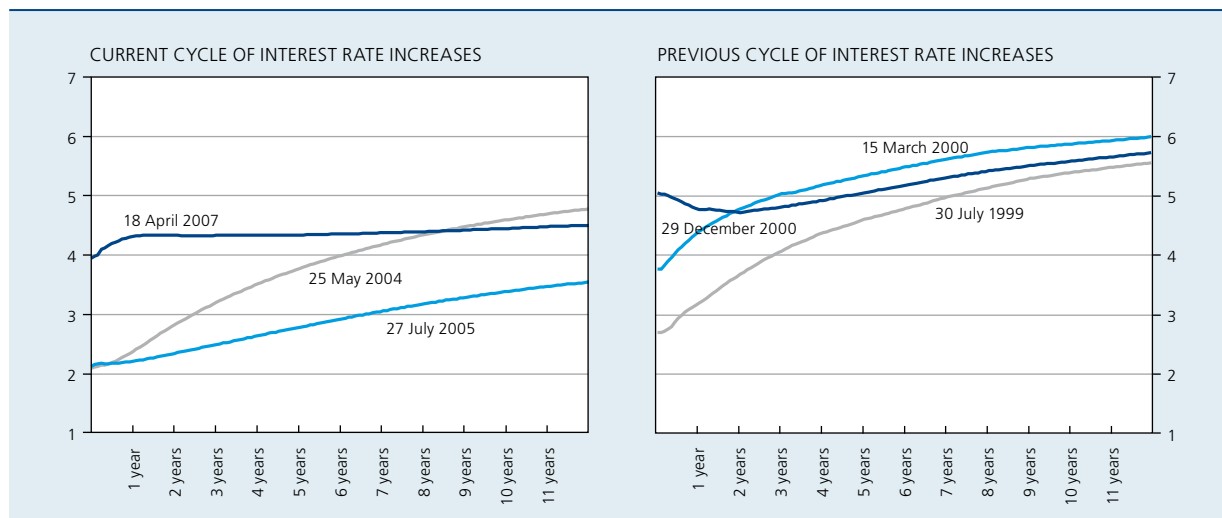
1.1 Historical perspective

Since mid 2004, there has been a marked flattening of the yield curve in the euro area. The spread between the ten-year interest rate on euro area government bonds and the three-month interest rate (EURIBOR) narrowed from 233 basis points in June 2004 to 28 basis points in April 2007. At that time, the curve was virtually flat, with interest rates hovering around 4 p.c. regardless of their term. Such a flat curve is a rather singular phenomenon, particularly if the current situation is compared with the previous cycle of interest rate increases, or if it is viewed in a historical perspective.

A more detailed analysis reveals that this flattening reflects two separate movements. First, it is due to a steep decline in long-term interest rates between mid 2004 and mid 2005, period during which short-term interest rates – in contrast – remained stable. The ten-year interest rate on euro area government bonds contracted by 119 basis points during that period, while the three-month interest rate remained unchanged, thus causing a marked flattening of the risk-free yield curve. Second, the flattening of the yield curve was amplified by the tightening of monetary policy in the euro area, beginning in December 2005. The ECB Governing Council raised the minimum bid rate for the main refinancing operations to 3.75 p.c. in March 2007, compared to 2 p.c. in December 2005. During that period, long-term interest rates increased by only 60 basis points.

(1) The author would like to thank A. Bruggeman and L. Aucremanne for their contribution.

CHART 1 THE YIELD CURVE IN THE EURO AREA
(percentage points)



Source : Datastream.

While the first factor is rather unusual, the second is normal. When the monetary authorities decide to tighten monetary conditions, notably in response to inflationary pressures, the main effect is an increase in short-term interest rates, as longer-term interest rates also increase but to a lesser extent. In fact, looking at maturities beyond the cycle, the expected short-term interest rate corresponds to the neutral interest rate which hardly changes over time, so that long-term rates are generally less volatile than short-term rates.

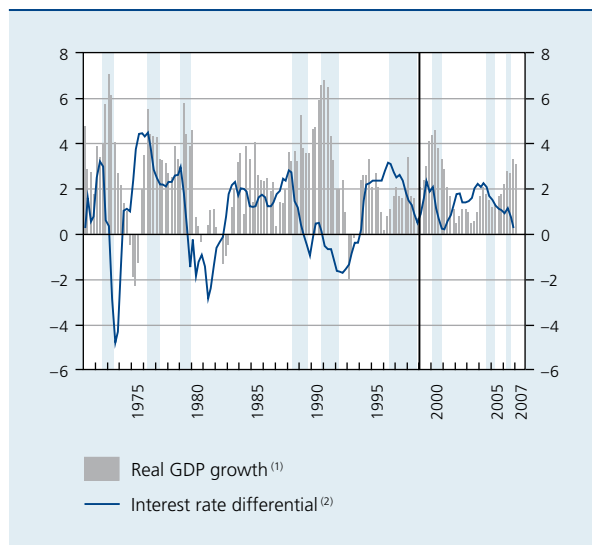
Thus, the yield curve also became flatter in the previous cycle of tighter monetary policy which began at the end of 1999. The flattening of the curve during the upward phase of the previous cycle of interest rate rises was, however, less pronounced than that seen since mid 2004. In March 2000, although short-term interest rates were at a level comparable to current rates, long-term interest rates were well above their present level so that the slope of the yield curve was still largely positive, though there was some cyclical flattening. After that, the Governing Council continued to increase interest rates, causing a more marked flattening of the yield curve and, furthermore, an inversion in the case of medium-term maturities. That inversion of the medium-term yield curve mainly reflected the fact that the markets considered that the cycle of increases had come to an end, and expected a relaxation of the monetary policy stance; that relaxation did in fact materialise subsequently. However, for longer-term horizons, the yield curve continued to exhibit

a rising profile. The current situation differs mainly in regard to the movement in long-term interest rates.

Taking a longer-term perspective, the evolution of the yield curve is traditionally analysed via the movements in its slope, measured as the spread between the ten-year interest rate and the three-month interest rate. In this article, the historical analysis will be based on German data for the period preceding stage 3 of EMU and on data relating to the euro area for the period beginning in January 1999. The spread was positive overall in the period from the first quarter of 1970 to the first quarter of 2007, averaging 105 basis points. This generally positive slope of the yield curve reflects the fact that investors traditionally demand a higher return on longer-term investments, owing to the risk associated with that type of investment (see box 1 for more details). The slope of the yield curve nevertheless fluctuated considerably around that average. It is possible to distinguish nine periods characterised by a narrowed spread, the last two corresponding to the periods giving rise to the current flattening already described. In the past, periods of yield curve flattening were generally followed by a substantial slowing of economic activity. In particular, periods when the yield curve was inverted tended to be followed by a recession after 4 to 6 quarters.

The yield curve is in fact generally regarded as a relatively reliable leading indicator of economic activity in many industrialised economies, such as the United States

CHART 2 THE YIELD CURVE AND GROWTH IN GERMANY AND IN THE EURO AREA
(percentage points, unless otherwise stated)



Sources: BIS, EC, OECD.

- (1) Percentage changes compared to the corresponding quarter of the previous year.
(2) Measured as the difference between the ten-year interest rate on government bonds and the three-month interest rate.

and Germany, but also in the euro area as a whole⁽¹⁾. The steep decline in the differential seen recently therefore prompts fears of a substantial downturn in the cycle. That explains why this phenomenon has given rise to questions about the economic outlook, not only in the euro area but also in the United States, where the yield curve is currently inverted.

As explained in box 1, the information provided by the yield curve on future economic fluctuations is based essentially on the fact that it incorporates expected short-term interest rates which in turn reflect economic agents' expectations regarding future economic activity. The signals provided by the yield curve may, however, be distorted by significant fluctuations in the risk premium. It is therefore important to understand the key factors behind the behaviour of the yield curve, and especially the low level of long-term interest rates.

(1) See in particular Ang et al. (2006), ECB (2006), Kremer and Werner (2006).

Box 1 – The expectations theory of the term structure of interest rates

According to the expectations theory of the term structure of interest rates, the yield on a government bond with a maturity N (I^N) may be regarded as the yield expected on a succession of N short-term bonds (I^1), to which is added a risk premium (RP^N) specific to the term of the bond.

$$I_t^N = \frac{1}{N} \left[I_t^1 + \sum_{i=1}^{N-1} E_t(I_{t+i}^1) \right] + RP_t^N$$

The existence of a risk premium reflects the fact that investors are generally risk averse, i.e. they prefer relatively secure investments to riskier investments. To invest in the latter, they therefore normally demand some compensation, commonly known as the "risk premium". In general terms, the risk premium depends on the issuer's quality, investors requiring a higher risk premium for securities issued by a less sound entity. In the case of government bonds, the issuer is of good quality so that the associated risk premium depends essentially on the term. That is why this risk premium is also known as a "term premium".

The risk premium primarily reflects the size of the risk, which in turn depends on the covariance between the return on the investment and the macroeconomic developments. In the case of assets which have a high covariance with the economic cycles, a significant risk premium is generally demanded, as investors attribute greater value to assets which, on average, secure a higher yield when economic activity is weak than when it is strong. Since covariance is the product of a correlation and two standard deviations, the risk premium is higher the greater the correlation between the bond yield and the macroeconomic evolution, on the one hand, and the greater the standard deviations of the bond yield and the macroeconomic trend, on the other hand. This therefore

means that the risk premium is a positive function of the term, thus explaining why the yield curve tends to slope upwards, on average. A second consequence is that, *ceteris paribus*, greater macroeconomic stability will depress the level of the risk premium.

The risk premium is also a positive function of the investor's risk aversion. Moreover, that degree of aversion may fluctuate over time. In particular, in certain circumstances, investors may have very low risk aversion, so that they demand a smaller risk premium. In exceptional circumstances, the risk premium may even become negative. In the case of government bonds, the risk premium is sometimes compressed by portfolio shifts reflecting a "flight to quality".

The total risk premium, like nominal interest rates, can be separated into two distinct elements: an inflation risk premium which compensates the investor for the uncertainty about future inflation, and a real risk premium which compensates for the uncertainty about future movements in real interest rates.

1.2 Flattening of the yield curve since mid 2004

To gain a better understanding of the low long-term interest rates seen since mid 2004, it is useful to break down the interest rate on a ten-year government bond into a five-year interest rate and an implied five-year forward rate five years ahead⁽¹⁾. The latter represents the yield expected on a five-year investment which will begin in five years' time and therefore incorporates a risk premium associated with a five-year investment, and an additional risk premium due to the fact that a commitment is being made today for a five-year investment starting five years ahead. The risk premium will therefore be greater for the implied five-year forward interest rate five years ahead. That is confirmed in practice as, during the period under review, the implied five-year forward interest rate five years ahead always exceeded the five-year interest rate. In view of this higher risk premium, the implied five-year forward interest rate five years ahead may therefore be affected to a greater extent by any changes in this risk premium.

During the period 2004-2005, it was specifically the implied five-year forward interest rate five years ahead that declined considerably to reach a historically low level. It dropped from 5.4 p.c. in June 2004 to 4 p.c. in June 2005, a decline of 1.4 percentage points, before stabilising since then at around 4 p.c. Although such a contraction may reflect a downward revision of expectations regarding future interest rates, box 2 shows that this is unlikely, and that the sharp contraction of the implied five-year forward interest rate five years ahead is due essentially to a decline in the risk premium.

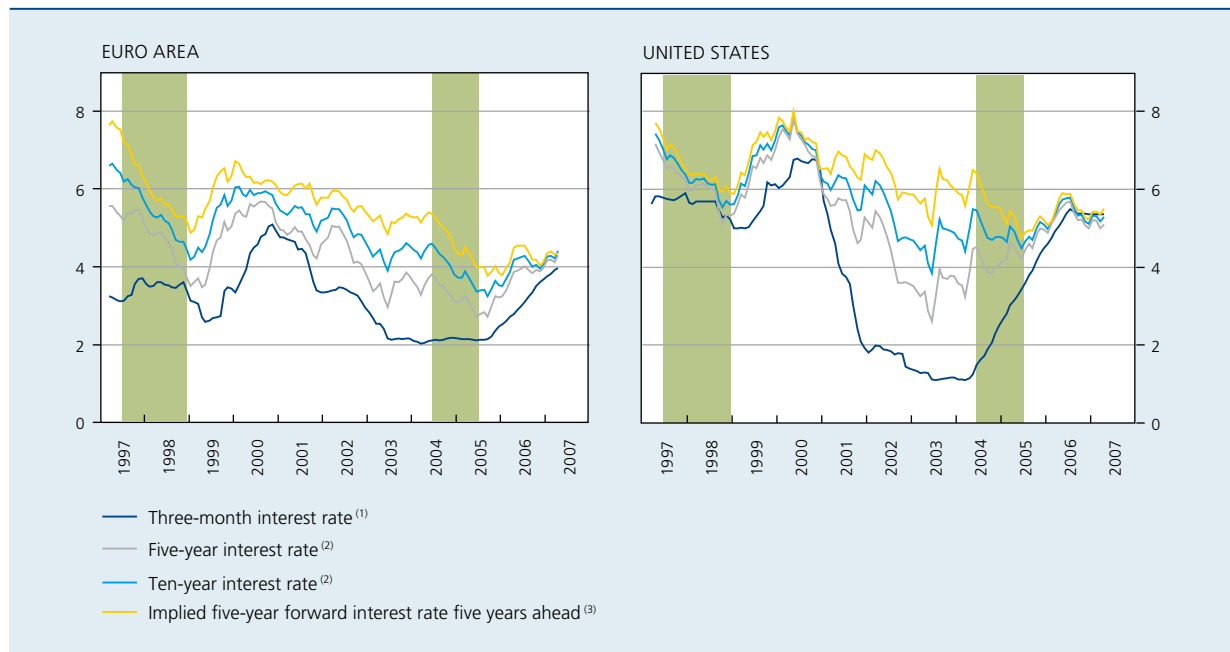
Such an explanation seems consistent with the fact that a largely comparable development was seen in the United States, where the implied five-year forward interest rate five years ahead recorded a 1.7 percentage points fall during the period from June 2004 to June 2005. If the period 2004-2005 is compared with the preceding cycles of tightening US monetary policy, it is evident that the rate increases which began in 2004 seem to have had a rather similar effect on the five-year interest rate on US bonds. Conversely, the ten-year interest rate remained abnormally insensitive, prompting Alan Greenspan, then chairman of the Federal Reserve, to call this phenomenon a "conundrum".

The flattening of the yield curve in the euro area and in the United States therefore seems to be due to similar factors, namely a contraction of the implied forward rate which in turn probably reflects a reduction in the risk premium, and a tightening of monetary policy. While the first factor occurred simultaneously in the two economies, owing to the increasing integration of the financial markets, US monetary policy was tightened sooner than that of the euro area, so that the flattening of the yield curve in the United States preceded that in the euro area; since mid 2006, the US yield curve has actually been inverted.

In the past, both the euro area and the United States had seen a similar period of sudden decline in the implied five-year forward interest rate five years ahead. Thus, between mid 1997 and the end of 1998, that rate had fallen sharply, whereas short-term interest rates had remained relatively stable. The decline in the implied five-year forward interest rate five years ahead between mid 1997 and the end of 1998 essentially reflects a "flight to quality" triggered

(1) This breakdown is based on zero-coupon interest rates on government bonds.

CHART 3 BREAKDOWN OF 10-YEAR INTEREST RATES IN THE EURO AREA AND THE UNITED STATES
(percentage points)



Sources: Datastream, NBB.

(1) Rate on three-month interbank deposits.

(2) Zero-coupon rate on government bonds.

(3) Measured by the zero-coupon rate on ten-year and five-year government bonds.

by various events. The Asian crisis from mid 1997 sparked the large-scale repatriation of capital invested in Asia and, more generally, in emerging countries. From mid 1998, the Russian crisis and the bankruptcy of the LTCM hedge fund in the United States further depressed government bond yields, as investors preferred secure and liquid

investments rather than corporate bonds and equities. In 1999, these portfolio movements began to be reversed, causing a correction of long-term interest rates. The situation prevailing at present might be slightly different. As will be explained and illustrated in section 2, the strong demand for government bonds in recent years has mainly

TABLE 1 ESTIMATES OF THE REDUCTION IN THE RISK PREMIUM: RESULTS OF SOME EMPIRICAL STUDIES
(basis points)

	Type of model	From June 1997 to December 1998	From June 2004 to June 2005
Euro area			
Kremer and Werner (2006)	Purely financial model, with three factors	-150	-83
ECB (2006)	Purely financial model, with two factors	n.	-99
United States			
Kim and Wright (2005)	Purely financial model, with three factors	-106	-107
Rudebusch, Swanson and Wu (2006) on the basis of the models:			
Bernanke, Reinhart and Sack (2005)	Macro-financial model, based on VAR	n.	-106
Rudebusch and Wu (2004)	Neo-Keynesian macro-financial model	n.	-57

come from atypical investors, such as Asian central banks and pension funds, and could be more persistent.

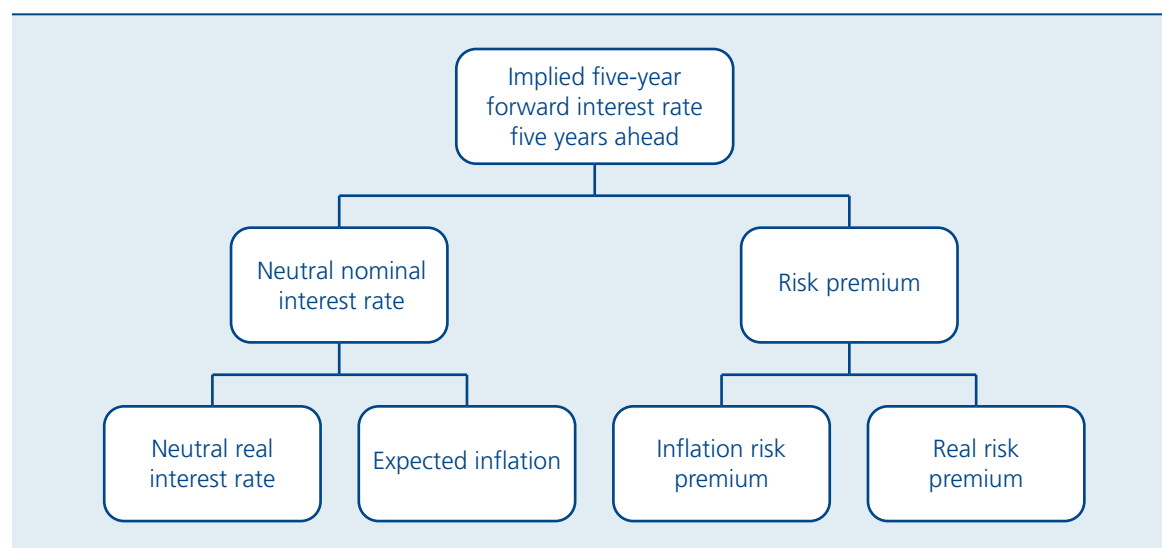
The argument that the low level of long-term interest rates is due mainly to a reduction in the risk premium is amply borne out by the results of various empirical studies conducted recently for the United States, Germany and the euro area. Thus, the results of these empirical studies show that the risk premium which investors demand on ten-year investments declined by 83 to 99 basis points over the period from June 2004

to June 2005, whereas it dropped by 150 basis points between June 1997 and December 1998. In the United States, the results obtained were generally similar. This implies that around 75 p.c. of the reduction in long-term interest rates seen between June 2004 and June 2005 was due to a decline in the risk premium. However, the models used provide no explanation of the potential reasons for this behaviour. Section 2 of this article describes the various factors which may have caused a reduction in the risk premium incorporated in long-term interest rates.

Box 2 – Is the risk premium responsible for the low level of long-term interest rates?

This box aims to determine the components of long-term interest rates which explain their low level, and in particular to analyse the contribution of the risk premium during the period from June 2004 to June 2005. For this purpose, a methodology similar to that of Kozicki and Sellon (2005) is used. That methodology is based on a breakdown of ten-year interest rates into a five-year rate and an implied five-year forward interest rate five years ahead. These two rates reflect, on the one hand, expectations relating to future movements in interest rates over the next five years and over the five years after that, and – on the other hand – a risk premium. That premium is higher for the implied five-year forward interest rate five years ahead. As regards interest rate expectations, the five-year interest rate mainly reflects expectations regarding the response of the monetary authorities to the economic cycle. The movement in the implied five-year forward interest rate five years ahead reflects the expectations of the economic agents on two points: the outlook for growth in five to ten years' time, which depends on structural factors determining potential growth, and long-term inflation expectations which depend on the central bank's inflation target. The expectations incorporated in the five-year rate in five years' time therefore correspond overall to the neutral nominal interest rate. Fluctuations in the risk premium may also affect the implied forward interest rate.

FIGURE 1 BREAKDOWN OF THE IMPLIED FORWARD INTEREST RATE



During the period 2004-2005, the implied five-year forward interest rate five years ahead declined sharply, dropping from 5.4 p.c. in June 2004 to 4 p.c. in June 2005, a fall of 140 basis points. A breakdown of the forward rate explains the underlying factors, as the neutral interest rate and the risk premium can be separated into a real and an inflation component.

Using financial data and survey findings, it is possible to calculate the contribution of these four components to the decline in the forward interest rate. The neutral real interest rate and the inflation expectations of the economic agents can be estimated via the results of the quarterly ECB Survey of Professional Forecasters (SPF). That survey provides information on experts' expectations for growth and inflation in the long term. In certain circumstances, the neutral real interest rate coincides with long-term growth, so that growth expectations at distant horizons may be regarded as an approximation of the neutral interest rate. If the inflation expectations as measured by the SPF are subtracted from the five-year break-even inflation rate five years ahead⁽¹⁾, an estimate of the inflation risk premium might be obtained (for more details on the break-even inflation rate, see below). The real risk premium can be calculated as a residual.

The SPF results indicate that growth expectations at a horizon of five years were only adjusted very slightly – from 2.3 p.c. to 2.2 p.c. – between June 2004 and June 2005 in the euro area, whereas inflation expectations at a horizon of five years remained unchanged at 1.9 p.c., thus in line with the ECB's definition of price stability. The neutral nominal interest rate therefore declined by only 10 basis points during the period 2004-2005. Thus, the main part of the decline in the forward rates seems to be attributable to a contraction of the risk premium. However, it is necessary to distinguish between the nominal component and the real component. As the five-year break-even inflation rate five years ahead showed a fall of 40 basis points while inflation expectations measured by the SPF remained unchanged, the inflation risk premium also contracted by 40 basis points. The real component of the risk premium, obtained as a residual, is therefore the key factor accounting for the decline in the overall premium. According to estimates, it fell by 90 basis points between June 2004 and June 2005. The real risk premium was therefore slightly negative in June 2005. This considerable reduction in the risk premium, which is confirmed by the results of more complex empirical studies, is probably due to the strong demand on the part of atypical investors, such as the Asian central banks and pension funds (see section 2 for more details).

ATTEMPT TO QUANTIFY THE FACTORS RESPONSIBLE FOR THE FALL IN THE IMPLIED FORWARD INTEREST RATE

(percentage points)

	June 2004	June 2005	Difference
Neutral nominal interest rate			
Neutral real interest rate	2.3	2.2	-0.1
Expected inflation	1.9	1.9	0.0
Risk premium			
Inflation risk premium	0.6	0.2	-0.4
Real risk premium	0.5	-0.3	-0.9
Implied five-year forward interest rate five years ahead . .	5.4	4.0	-1.4

Sources: SPF, ECB, NBB.

(1) The five-year break-even inflation rate five years ahead is calculated as the difference between twice the ten-year break-even inflation rate and the five-year break-even inflation rate.



1.3 Influence of the decline in the risk premium on the quality of the yield curve as a leading economic indicator

The ability of the yield curve to anticipate future economic fluctuations is based essentially on the fact that the expectations of the economic agents are incorporated in the long-term interest rates. In particular, market expectations regarding future real interest rate movements essentially reflect their expectations concerning the monetary authorities' response to the business cycles. For example, if the economic agents expect an improvement in economic activity, that traditionally causes an increase in long-term interest rates which, *ceteris paribus*, immediately results in a steeper yield curve. If the expectations are fulfilled, the widening of the spread should therefore be accompanied by an economic expansion. However, the reliability of the yield curve as a leading indicator of economic activity may be affected by sizeable changes in the risk premium, as any significant increase or decrease in the risk premium tends to distort the signals provided by that indicator.

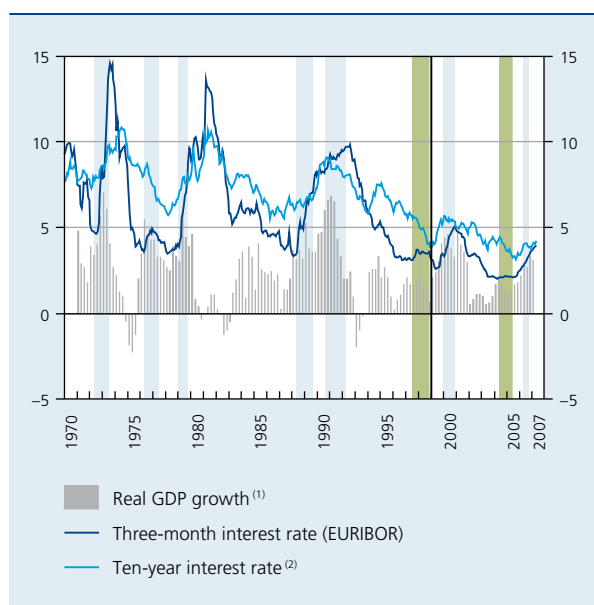
The two periods of significant decline in the risk premium analysed above, namely mid 1997 to the end of 1998 and mid 2004 to mid 2005, are also atypical, in historical

terms in that, during those periods, it is mainly a reduction in long-term interest rates that causes the flattening of the yield curve, while short-term interest rates remained relatively stable. As explained above, these reductions were most likely due to a contraction in the risk premium, and not to a downward adjustment of growth or inflation expectations. In contrast to other periods when the yield curve became flatter, these two specific periods were not accompanied by any economic slowdown. On the contrary, since the reduction in the risk premium causes financial conditions to ease, it was one of the factors contributing to the acceleration of economic activity during the quarters which followed those two periods.

These findings suggest that the spread should be adjusted for fluctuations in the risk premium when it is used as a leading indicator of business cycles. Empirical studies⁽¹⁾ have shown that the spread adjusted for the risk premium – i.e., the spread after deduction of the estimated risk premium – provided signals regarding future economic activity which were more accurate than those offered by the non-adjusted indicator. In that context, it is noteworthy that the flattening of the yield curve caused by the tightening of monetary policy since December 2005 is additional to a flattening caused by a sharp decline in the risk premium. The consequences for future economic activity of the current flattening of the yield curve therefore need to be significantly qualified. On the basis of the estimated risk premia obtained by Kremer and Werner (2006), the ECB (2006) shows that the yield curve adjusted for the risk premium does not currently appear to herald any major slowdown in economic activity, but rather the expectation of a return to sustainable growth, close to potential, after several quarters of particularly strong growth.

Traditionally monitored leading indicators of the business cycle tend to corroborate the conclusions deduced from the spread adjusted for the risk premium. Both business and consumer confidence indicators have reached record levels in recent months; furthermore, the majority of them are still rising. Also, the projections produced by various bodies are generally optimistic. The recent projections produced by the Eurosystem in June 2007, for example, predict euro area growth close to potential growth for the period 2007-2008.

CHART 4 INTEREST RATES AND GROWTH IN GERMANY AND IN THE EURO AREA
(percentage points, unless otherwise stated)



Sources: BIS, EC, OECD.

(1) Percentage changes compared to the corresponding period of the previous year.

(2) In Germany's case, this is the ten-year German Bund. In the case of the euro area, it is an average of the yields on bonds issued by euro area member countries, weighted by their respective levels of public debt.

(1) See in particular Ang, et al. (2006) for the United States and Kremer and Werner (2006) for Germany.

1.4 Influence of the reduction in the risk premium on the quality of the break-even inflation rate as an indicator of inflation expectations

Since the aim of the ECB's monetary policy is to maintain price stability in the medium term, the European monetary authorities keep a very close eye on an indicator of inflation expectations known as the break-even inflation rate. It is defined as the difference between a nominal bond yield and the real yield on an inflation-indexed bond with a similar maturity and issuer. The break-even inflation rate therefore provides information on the average inflation rate expected during the term of the bond on which the calculation is based. At that inflation rate, the nominal yield expected by the investor will be the same whether the money is invested in a nominal bond or in an inflation-indexed instrument.

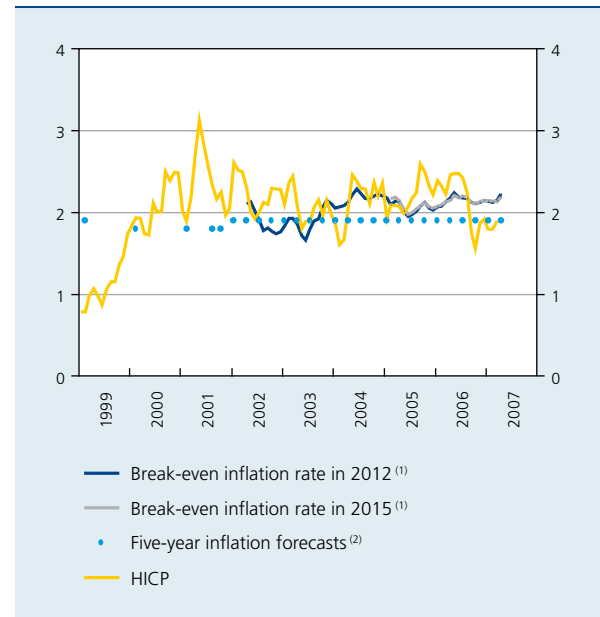
Nonetheless, this indicator of inflation expectations is not perfect, as it incorporates two types of premium which cannot be observed. First, the break-even inflation rate contains an inflation risk premium which offers the investor in nominal bonds compensation for the uncertainty over inflation. That premium therefore implies that the break-even inflation rate tends to overestimate inflation expectations. Second, it also comprises a liquidity premium which compensates the index-linked bond investor for the lower liquidity on this type of market, compared to the market in traditional nominal bonds. Unlike the inflation risk premium, the existence of the liquidity premium causes the inflation expectations of economic agents to be underestimated. Although it is impossible to determine precisely the level of the overall premium, it nevertheless appears that the liquidity of the indexed bond market has greatly improved in recent years, witness in particular the sizeable increase in the outstanding volume of this type of financial instruments⁽¹⁾. That improvement therefore probably does much to explain the increase in the break-even inflation rate in the second half of 2003. In view of these developments, it is currently thought that the inflation risk premium tends to exceed the level of the liquidity premium, so that the break-even inflation rate probably overestimates somewhat inflation expectations of economic agents.

(1) According to the Direction générale du Trésor et de la politique économique française (2005), the outstanding amount of indexed bonds issued by the French government increased from about 4.3 billion euro in 1998 to 29.5 billion in 2003, and over 90.35 billion at the end of 2005. Stronger demand from investors (pension funds, etc.) and improvements made by issuers (reform of the regulations, more regular tenders) have made this market much more efficient.

(2) See in particular box 2 and ECB (2007).

(3) Bonds indexed to the HICP (excluding tobacco) of the euro area, issued by the French government.

CHART 5 INFLATION EXPECTATIONS IN THE EURO AREA
(annual percentage change)



Sources : SPF, ECB, EC.

(1) The break-even inflation rate corresponds to the difference between the yields on nominal government bonds and the yields on government bonds linked to the HICP (excluding tobacco) of the euro area, issued by the French government and maturing at the horizon indicated.

(2) Quarterly ECB Survey of Professional Forecasters.

As stated in boxes 1 and 2, the risk premium on a traditional bond can be broken down into two elements: a real risk premium and an inflation risk premium. That breakdown shows that it is mainly the real component of the risk premium that declined considerably in the period 2004-2005. Although the inflation risk premium also declined somewhat⁽²⁾, that fall seems to be relatively small compared to the decline in the real component. Therefore, the quality of the break-even inflation rate as an indicator of inflation expectations seems to have been little affected during the period of the flattening of the yield curve.

Since January 2004, the break-even inflation rate – measured via indexed bonds maturing in 2012⁽³⁾ – has hovered around 2.1 p.c. A broadly similar picture emerges from indexed bonds maturing in 2015. If the risk premium incorporated in the break-even inflation rate is taken into account, this pattern appears largely comparable to that shown by inflation expectations measured on the basis of the quarterly ECB Survey of Professional Forecasters (SPF). Those expectations have remained steady at 1.9 p.c. since January 2002, despite a succession of exogenous shocks which have hit the European economy in recent years (oil, BSE crisis, increases in indirect taxation, etc.)

and have pushed inflation in the euro area above the 2 p.c. threshold for the past seven years running. It is also important to note that the decline in long-term interest rates cannot be attributed to a downward drift of inflation expectations. Although the deflation risk emerged mainly in the United States in 2002-2003, fears also intensified to some extent in the euro area, prompting the ECB Governing Council to clarify among others its monetary policy strategy in May 2003.

2. Factors potentially responsible for the reduction in the risk premium

Two main factors may explain the contraction of the risk premium in recent years. First, that reduction may be due to a decline in the risk associated with investments in long-term bonds, reflecting less uncertainty about future interest rate movements. A reduction in risk aversion is a second factor which may have contributed to the low bond yields. While the first factor affects the size of the risk, the second has an impact on the risk valuation. The next two sub-sections examine these two factors in more detail.

2.1 Reduction in uncertainty over future interest rate movements

Two complementary factors may be put forward to explain the decline in uncertainty over future interest rate movements. First, for a number of years now there has been greater macroeconomic stability, reflected in particular in lower volatility of economic growth and inflation. This phenomenon is commonly known as the “great moderation”⁽¹⁾. Thus, the difference between economic growth and inflation on the one hand and their trend levels – measured by an HP filter – can be regarded as an indicator of the economic cycle or inflation. On the basis of the data for Germany covering the period 1970-2007⁽²⁾, a significant reduction in the amplitude of these cycles is apparent. The standard deviation of this difference declined from 1.9 percentage points over the period from the first quarter of 1970 to the last quarter of 1984 to 1.1 percentage points over the period from the first quarter of 2000 to the last quarter of 2006 for economic growth, and from 1 to 0.5 percentage point for inflation. In the United States, a broadly similar decline in

TABLE 2 VOLATILITY OF GROWTH AND INFLATION IN GERMANY

(standard deviation of the difference in relation to the trend⁽¹⁾)

	1970-1984	1985-1999	2000-2006
Real GDP growth	1.9	1.4	1.1
Inflation	1.0	0.7	0.5

Sources: EC, NBB.

(1) Measured by an HP filter.

volatility was also observed⁽³⁾. Various factors may explain this “great moderation”.

First, the economy has gradually undergone major structural changes which have increased its flexibility and fostered its ability to absorb shocks. Those changes include the structural reforms designed to increase the flexibility of the product, labour and financial markets, the improvement in organisation and stock management, and world trade growth. Second, as a result of the improvement in the conduct of monetary policy, which is now geared to price stability, and the accompanying institutional reforms, the inflation expectations of economic agents are now more firmly anchored, thus reducing inflation volatility. Finally, it is also likely that the macroeconomic stability may be due to the fact that, in recent years, the shocks hitting the economy have been more infrequent, or smaller than those which occurred in the 1970s and 1980s. In that case, the “great moderation” would be due to chance rather than to any intrinsic stability of the economy, or more effective economic policies.

Apart from the greater macroeconomic stability, the efforts made by the central banks in terms of communication and transparency may also account for the reduction in uncertainty over future interest rate movements. In recent years, many central banks have endeavoured to improve communication about their monetary policy strategy, particularly by announcing an explicitly quantified inflation target so that inflation expectations can be firmly anchored. In latter years, a number of central banks have also offered detailed explanations of their monetary policy decisions, by issuing press releases in which they justify their decisions on the basis of macroeconomic and financial data and by organising press conferences after every monetary policy meeting, as is the case for the ECB, for instance. Finally, certain central banks have recently begun announcing information on movements in future interest rates. While the New Zealand, Norwegian and Swedish monetary authorities have decided to publish

(1) Bernanke (2004).

(2) In this particular case, only data for Germany covering the entire period are used, as the calculation of the standard deviation could imply an artificial downward bias if data for the euro area since 1999 were used. The reason is that shocks limited to certain national economies tend to cancel one another out at the euro area level.

(3) See in particular Stock and Watson (2002).

their forecasts for the future trend in interest rates, other central banks such as the Federal Reserve and the ECB have recently provided qualitative information.

Nonetheless, it should be noted that, while these two factors – namely macroeconomic stability and a more predictable monetary policy – may explain the downward trend in the risk premium, they probably played a much less important role in the sudden reduction in the risk premium between mid 2004 and mid 2005. In that regard, the reduction in risk aversion is regularly cited as the reason for this behaviour on the part of the risk premium.

2.2 Reduction in risk aversion

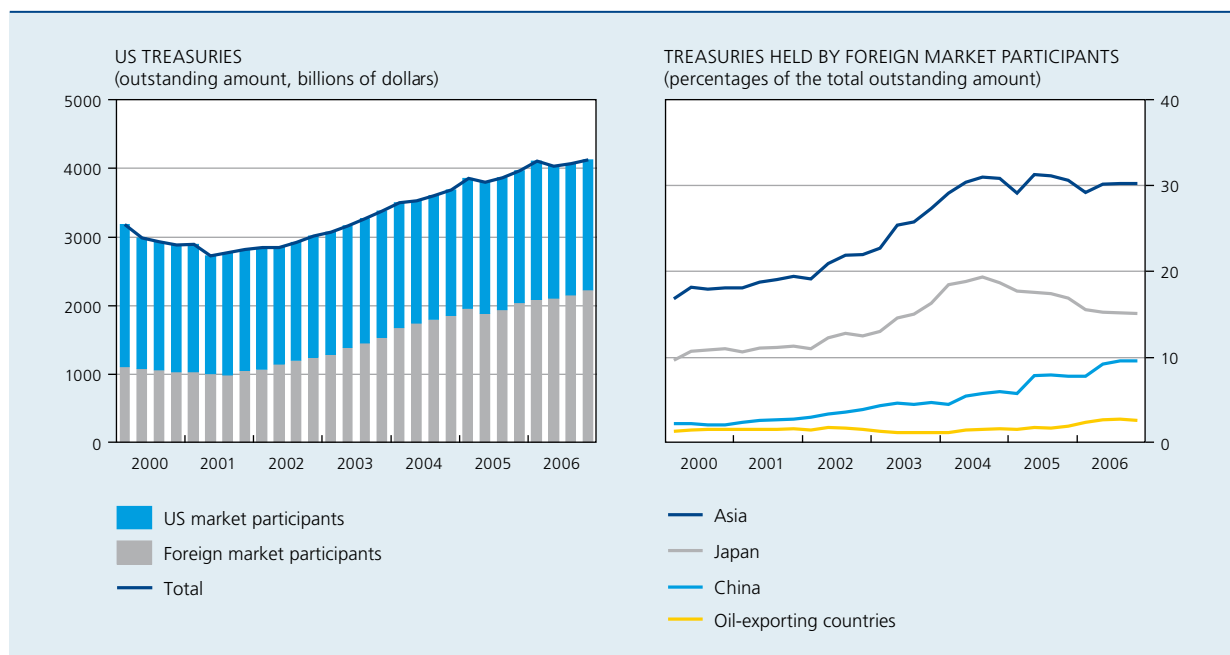
2.2.1 Strong demand for bonds on the part of Asian economies and oil-exporting countries

The reduction in the risk premium between mid 2004 and mid 2005 seems to be due mainly to a decline in risk aversion. A key factor here is the substantial increase in demand for long-term government bonds, principally on the part of atypical investors whose demand is generally rather price inelastic. In particular, Asian central banks, and to a lesser extent oil-exporting countries, have exhibited very strong demand for government bonds in

recent years, more specifically for long-dated bonds issued by the US Treasury. The Asian governments conduct policies which are essentially oriented to the development of foreign trade, enabling them to record substantial trade surpluses. They also establish ample foreign exchange reserves in order to prevent the appreciation of their currency which could result from those trade surpluses. According to International Monetary Fund data, the foreign exchange reserves accumulated by China and Japan increased respectively from 286 to 1,066 billion dollars and from 451 to 875 billion dollars between 2002 and 2006. Moreover, although exact figures are not available, these reserves seem to consist largely of government securities denominated in dollars, as the US currency is still the major currency used in international trade. The recycling of surplus savings recorded by oil-exporting countries following the steep rise in oil prices is also regularly cited as an additional factor which may have contributed to the low level of long-term interest rates.

These factors are borne out by the Treasury International Capital System (TICS) figures, which indicate that foreign market participants' demand for US Treasury securities more than doubled between March 2002 and December 2006, whereas the public debt increased by only 45 p.c. Consequently, the proportion of US government securities held by foreigners stood at 54 p.c. in December 2006, against 37 p.c. in March 2002. More detailed figures

CHART 6 FOREIGN DEMAND FOR US TREASURY SECURITIES



Source : U.S. Department of the Treasury.

show that, among the foreign market participants, China, Japan and oil-exporting countries held over 53 p.c. of US government securities in December 2006. But demand from China and Japan is the main factor contributing to the increase in the total amount of US government securities held by foreign operators; while the demand from oil-exporting countries has risen, the increase is small. Finally, it seems that it is mainly official market participants, particularly central banks, that have contributed to this growth of foreign demand for US government securities, over 85 p.c. of which are held in the form of securities at over one year. Although Asian central banks and oil-exporting countries have displayed a strong preference for US securities, the increasing integration of the financial markets implies that the decline in US interest rates resulting from that stronger demand has also been transmitted to Europe via arbitrage mechanisms.

2.2.2 Strong demand for bonds from pension funds

Apart from the emerging economies, pension funds and life insurance companies have also shown increasing interest in long-dated government securities. Various factors have contributed to this development. First, population ageing in the industrialised countries has caused individuals to become more interested in life insurance products and in the second and third pillars of the pension system, particularly in view of the growing uncertainty over the medium- and long-term viability of the pay-as-you-go pension system, and hence on the ability of governments to guarantee future pension payments. Second, as the 'baby boom' generation will retire in the coming years, these institutional investors have given preference to secure investments, i.e. primarily government securities. Third, in recent years, pension funds have restructured their assets in favour of long-term government securities in order to improve the matching between the duration of their liabilities, which are mainly long term, and those of their assets. These movements were encouraged by the IAS/IFRS accounting reforms introduced recently, and by the heavy portfolio losses sustained at the time of the bursting of the technology bubble in 2001.

However, if it is sufficiently substantial, this stronger demand for long-term government bonds could lead to an actuarial pension fund deficit, i.e. a situation in which the actuarial value of the assets is less than the actuarial value of their liabilities. In that case, they would therefore be forced to invest more in long-term securities, thus amplifying the decline in long-term interest rates and their actuarial deficit. One currently considers that demand from institutional investors is still insufficient to produce that effect. However, in view of population ageing, demand for such financial assets is expected to

increase significantly in the future, and that could have a considerable impact on long-term interest rates. But at the moment, there are few figures available to illustrate that trend.

2.2.3 Abundance of liquidity

Leaving aside the strong demand from atypical investors, which tends to have a more structural downward effect on interest rates, the abundance of liquidity on financial markets caused partly by the fact that monetary policy has been accommodating in most industrialised countries over a relatively long period may also have helped to reduce the risk premiums incorporated in long-term interest rates. There are two channels through which the accommodative monetary policy has encouraged low interest rates.

First, in the past, ample liquidity was generally accompanied by substantial increases in the price of certain assets, such as equities and real estate. Although speculative bubbles on the bond market are less common, since the prices of these securities are fixed at maturity, bond prices may also be subject to very steep increases in certain circumstances. Given the relatively great risk aversion following the 2001 stock market crash and the decline in interest rates in the United States and Europe from 2001, market participants favoured short-term borrowing and investments in long-term securities, remunerated at higher interest rates. Part of the liquidity may therefore have boosted demand for long-term securities and hence encouraged the fall in long-term interest rates.

Second, by encouraging carry trade transactions on the foreign exchange markets, the accommodating monetary policy in certain economies may also have held long-term interest rates down to a relatively low level. These transactions consist in borrowing a low-interest currency and investing it in securities denominated in a currency which yields a higher interest rate. From 2004, the Federal Reserve gradually began tightening its monetary policy, thus causing a widening differential between the remuneration of dollar-denominated securities and that of securities denominated in other currencies such as the yen. These movements encouraged the rise in the price of dollar-denominated securities, thus depressing their yield. Moreover, these carry trade transactions contributed to the depreciation of currencies attracting low remuneration, thereby amplifying this phenomenon. Although there are few figures on these speculative transactions and their potential impact on long-term interest rates, the turbulence on the financial markets at the end of February showed that these portfolio movements could be considerable.

However, it should be noted that the combination of abundant liquidity and low interest rates need not imply that ample liquidity depresses interest rates. The reverse causality could also be valid. Thus, the low level of long-term interest rates reduces the opportunity cost of holding short-term financial assets, and therefore encourages investors to put their money into short-term assets such as time deposits, which are included in the monetary aggregates.

Conclusions

Since mid 2004, the yield curve has become considerably flatter, not only in the euro area but also in the United States, where it has even been slightly inverted since mid 2006. Analysis has shown that, apart from the tightening of monetary policy, reasons for this phenomenon lie in a substantial fall in the risk premium and, in particular, its real component over the period from mid 2004 to mid 2005. Analysis also suggests that this contraction, which has since been consolidated, was caused mainly by strong demand for government bonds on the part of atypical investors, and particularly Asian central banks and pension funds. These investors, especially the Asian central banks, have preferred to hold US securities. However, the progressive integration of the financial markets means that these factors have also had an impact in the euro area.

This article also examined how the reduction in the risk premium affected the quality of the signals provided by the yield curve as a leading indicator of the business cycles, and by long-term interest rates as an indicator of the inflation expectations of economic agents.

As the reduction in the inflation risk premium makes only a small contribution towards lowering the overall risk premium, the reliability of the break-even inflation rate as an indicator of inflation expectations is not really affected. However, the existence of an – admittedly small – inflation premium incorporated in the break-even inflation rate does render that indicator imperfect. Since

2004, break-even inflation has hovered around 2.1 p.c. which, taking account of this risk premium, corresponds to price stability as defined by the ECB Governing Council. This therefore suggests that the European monetary authorities have been successful in firmly anchoring inflation expectations.

Conversely, the analysis showed that the quality of the yield curve as a leading indicator of the business cycles is affected by the contraction of the risk premium. It is precisely because the flattening of the yield curve is due to a change in the risk premium rather than a revision of interest rate expectations that the current behaviour of the yield curve should not be interpreted as a sign heralding a marked slowdown in economic activity. After several quarters of exceptional growth, however, a return to sustainable growth may be expected, and that is consistent with the tightening of monetary policy which began in December 2005. In the current context featuring significant variations in the risk premium, it is therefore essential to consider these changes when the yield curve is used as a leading indicator of economic activity.

Finally, the flattening of the yield curve may also have more direct implications for the conduct of monetary policy. Generally speaking, the contraction of the risk premium is accompanied by an easing of financial conditions, which tends to stimulate aggregate demand. Such a situation may therefore generate inflationary pressures. Consequently, the monetary authorities need to exercise greater vigilance in order to ensure medium-term price stability. That increased vigilance is particularly necessary if the reduction in the risk premium is not due to a change in the macroeconomic fundamentals. In the latter case, there is also the risk of a possible upward correction to long-term interest rates. However, it should also be noted that, at present, the demand displayed by atypical investors might be more structural than the demand resulting from the “flight to quality” which caused the decline in the risk premium during 1997-1998. The reduction in the risk premium between June 2004 and June 2005 therefore might be more persistent than that seen between mid 1997 and the end of 1998.

Bibliography

- Ang A., M. Piazzesi and M. Wei (2006), "What does the yield curve tell us about GDP growth?", *Journal of Econometrics*, 131, 359-403.
- ECB (2006), "The recent flattening of the euro area yield curve: what role was played by risk premia?", *ECB Monthly Bulletin*, December, 32-33.
- ECB (2007), "Long-term real and inflation risk premia in the euro area bond market", *ECB Monthly Bulletin*, April, 28-29.
- Bernanke B. (2004), Speech at the Meetings of the Eastern Economic Association, Washington, DC, February 20.
- Bernanke B., V. Reinhart and B. Sack (2005), "Monetary policy alternatives at the zero bound: an empirical assessment", *Brookings Papers on Economic Activity*, 2, 1-78.
- Direction générale du Trésor et de la politique économique (2005), *Diagnostics Prévisions et Analyses Économiques: un bilan de l'émission des obligations françaises indexées sur l'inflation*, November 2005.
- Kim D.H. and J.H. Wright (2005), *An arbitrage-free three-factor term structure model and the recent behavior of long-term yields and distant-horizon forward rates*, Finance and Economics Discussion Series, Federal Reserve Board, 2005-33.
- Kozicki S. and G. Sellon (2005), *Long-term Perspectives on the Yield Curve and Monetary Policy*, Federal Reserve Bank of Kansas City, Economic Review, 4th quarter.
- Kremer M. and T. Werner (2006), *Do term premia affect the predictive power of the German yield curve for future economic activity?* mimeo.
- Rudebusch G.D., E.T. Swanson and T. Wu (2006), *The bond yield "conundrum" from a macro-finance perspective*, Federal Reserve Bank of San Francisco Working Paper Series, 2006-16.
- Rudebusch G.D. and T. Wu (2004), *A macro-finance model of the term structure, monetary policy and the economy*, Society for Economic Dynamics Meeting Papers, 104.
- Stock, J. and M. Watson (2002), "Has the business cycle changed and why?" NBER Working Paper Series, 9127.